LISTING OF CLAIMS:

1. (Currently amended) An apparatus for detecting a direction of a target to be detected by transmitting and receiving radio waves through a plurality of transmission/reception channels causing a phase difference in signals to be received through the transmission/reception channels and calculating the direction based on the phase difference, ~~at least one of~~a transmission antenna and a reception ~~antennas being provided to form~~antenna included in the plurality of transmission/reception channels, the apparatus comprising:

a direction calculating device ~~configured to calculate~~calculating the direction of the target based on the phase difference in the received signals on the assumption that the phase difference is within a range of $-\pi$ to $+\pi$ [rad]:

a range determining device ~~configured to determine~~determining that the target exists in any of azimuthal angle ranges each corresponding to ranges defined by $(2m-1)\pi$ to $(2m+1)\pi$ [rad] (m is an integer): and

a direction correcting device ~~configured to correct~~correcting the direction calculated by the direction calculating device according to a result determined by the range determining device.

2. (Original) The apparatus according to claim 1, further comprising a memory device for memorizing history information in relation to positional information including at least the direction target by target,

wherein the range determining device is configured to determine the azimuthal angle range on the basis of the history information memorized by the memory device.

3. (Currently amended) The apparatus according to claim 1, further comprising an imaging device ~~configured to acquire~~acquiring a two-dimensional image through a field of view

of an angular range being wider than and including the azimuthal angle range corresponding to the range of $-\pi$ to $+\pi$ [rad] of the phase difference; and

a distance calculating device ~~configured to calculate~~calculating a difference of the target based on transmitted and received signals of the radio waves,

wherein the range determining device comprises:

a mapping member configured to map, every azimuthal angle range, a position at which the target is to be detected on the two-dimensional image acquired by the imaging device on the basis of each direction respectively calculated using the phase difference between the received signals on the assumption that the phase difference is within each of ranges defined by $(2m-1)\pi$ to $(2m+1)\pi$ [rad] and the distance calculated by the distance calculating device;

a first determination member configured to determine whether or not the target is imaged at each position on the two-dimensional image acquired by the mapping member; and

a second determining member configured to determine the azimuthal angle range in which the target exists, on the basis of a determined result of the first determination member.

4. (Original) The apparatus according to claim 3, wherein the imaging device is a CCD camera.

5. (New) The apparatus according to claim 1, wherein the transmission antenna is one of a plurality of transmission antennas and the reception antenna is one of plural reception antennas, to form part of a plurality of reception channels involved in the plurality of transmission/reception channels, the transmission antenna transmitting the radio waves into an

overall area to be detected and the plural reception antennas receiving radio waves reflected from the area.

6. (New) The apparatus according to claim 5, wherein the plural reception antennas are linearly arranged and are spaced apart at equal intervals.

7. (New) The apparatus according to claim 6, wherein the transmission antenna is coupled with a transmitter for transmitting the radio waves via the transmission antenna and each of the plurality of reception channels includes a path connected to each of the plural reception antennas, each path including a mixer, an amplifier, and an analog-to-digital converter arranged in order from each reception antenna, wherein

each mixer receives a reception signal from each reception antenna and a local signal from the transmitter, and mixes the received reception signal with the received local signal to produce a mixed signal,

each amplifier amplifies the mixed signal from each mixer to produce an amplified signal, and

each analog-to-digital converter converts the amplified signal from each amplifier to produce a corresponding digital signal.

8. (New) The apparatus according to claim 1, wherein the radio waves are millimeter wave-band radio frequency waves.

9. (New) The apparatus according to claim 2, wherein there is one transmission antenna and the reception antenna is one of plural reception antennas, to form part of a plurality of reception channels involved in the plurality of transmission/reception channels, the transmission antenna transmitting the radio waves into an overall area to be detected and the reception antennas receiving radio waves reflected from the area.

10. (New) The apparatus according to claim 9, wherein the plural reception antennas are linearly arranged and are spaced apart at equal intervals.

11. (New) The apparatus according to claim 10, wherein the transmission antenna is coupled with a transmitter for transmitting the radio waves via the transmission antenna and each of the plurality of reception channels includes a path connected to each of the plural reception antennas, each path including a mixer, an amplifier, and an analog-to-digital converter arranged in order from each reception antenna, wherein

each mixer receives a reception signal from each reception antenna and a local signal from the transmitter, and mixes the received reception signal with the received local signal to produce a mixed signal,

each amplifier amplifies the mixed signal from each mixer to produce an amplified signal, and

each analog-to-digital converter converts the amplified signal from each amplifier to produce a corresponding digital signal.

12. (New) The apparatus according to claim 3, wherein there is one transmission antenna and the reception antenna is one of plural reception antennas, to form part of a plurality of reception channels involved in the plurality of transmission/reception channels, the transmission antenna transmitting the radio waves into an overall area to be detected and the reception antennas receiving radio waves reflected from the area.

13. (New) The apparatus according to claim 12, wherein the plural reception antennas are linearly arranged and are spaced apart at equal intervals.

14. (New) The apparatus according to claim 13, wherein the transmission antenna is coupled with a transmitter for transmitting the radio waves via the transmission antenna and each of the plurality of reception channels includes a path connected to each of the plural reception antennas, each path including a mixer, an amplifier, and an analog-to-digital converter arranged in order from each reception antenna, wherein

each mixer receives a reception signal from each reception antenna and a local signal from the transmitter, and mixes the received reception signal with the received local signal to produce a mixed signal,

each amplifier amplifies the mixed signal from each mixer to produce an amplified signal, and

each analog-to-digital converter converts the amplified signal from each amplifier to produce a corresponding digital signal.